A new active base of photomultiplier R4125 designed for the $PbWO_4$ calorimeter

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***Abstract*—This paper presents the design, performance, and results of the radiation tests of an active base for Hamamatsu R4125 photomultiplier tube. The active base was designed at Jefferson Lab and comprises of a high voltage divider and an on-board amplifier. The photomultiplier with the active base is used to detect light from lead tungstate scintillating crystals of the forward electromagnetic calorimeter of the GlueX detector. The active base amplifier allows to operate the tube at lower high voltage and thus to limit the photomultiplier anode current to a few micro ampereres at the maximum counter rate of 1 MHz counter, while retaining the dynamic range of output signals. The performance of calorimeter modules instrumented with the active base was studied using detector prototypes positioned into the beam of photons. The key performance parameters such as the linearity, high-rate capability, and the energy resolution verified that the active base design meets the detector specifications. The resistance of the active base components to radiation was studied using Caesium-137 source. Some damages observed required to make modifications to the original base design.**

I. Introduction

A. Test

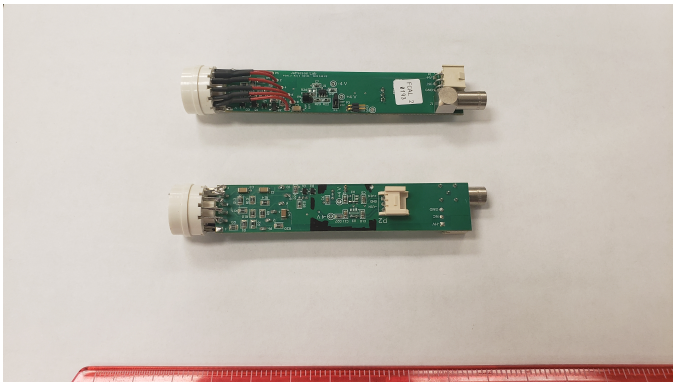

Fig. 1. Active base for Hamamatsu R4125 photomultiplier tube.

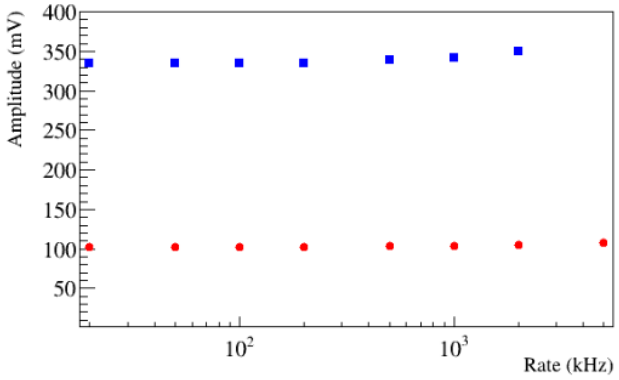

Fig. 2. Signal amplitude induced by a laser pulser as function of the rate.

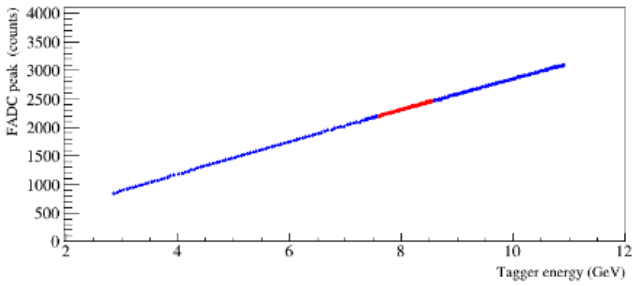

Fig. 3. Signal pulse amplitude obtained from the calorimeter module as a function of the photon beam energy. The amplitude is given in units of flash ADC counts.

Acknowledgment

Work supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under contract DE-AC05-06OR23177.

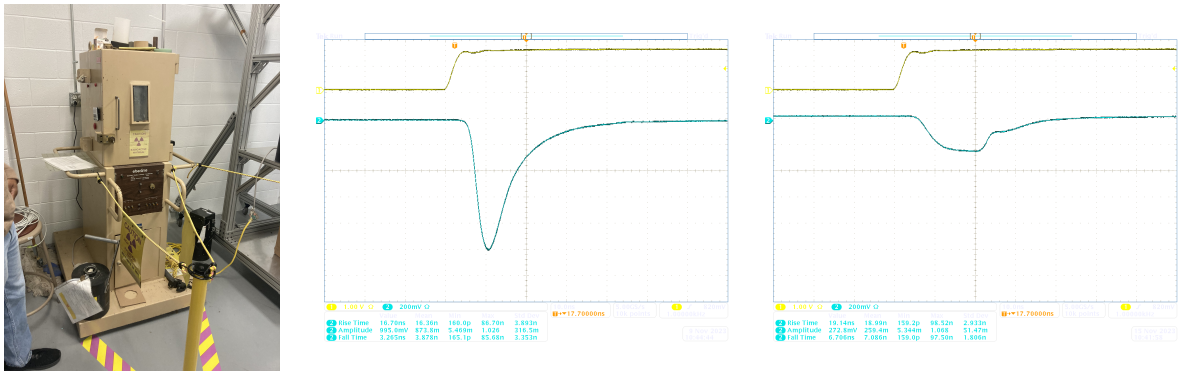

Fig. 4. Signal pulse induced by an LED before irradiation (left) and after the failure of the power regulator at a dose of 20 kRad (right).

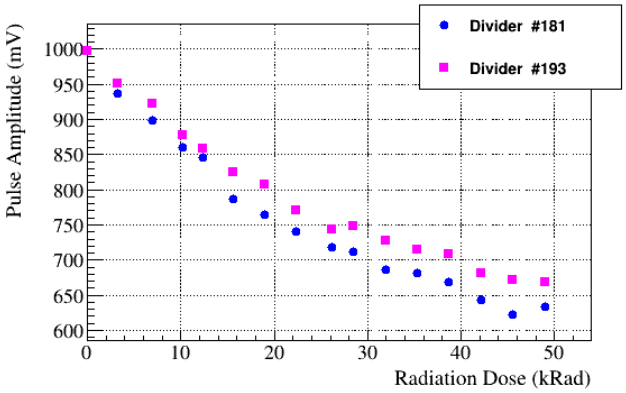

Fig. 5. Degradation of an active base amplitude induced by an LED as a fanction of the accumulated dose.

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